

Claims

What is claimed is:

1. A method for controlling a temperature in a combustion cylinder in an internal combustion engine, the cylinder being fluidly connected to an intake manifold and an exhaust manifold, comprising the steps of:

increasing a back pressure associated with the exhaust manifold to a level sufficient to maintain a desired quantity of residual exhaust gas in the cylinder; and

varying operation of an intake valve located between the intake manifold and the cylinder to an open duration sufficient to maintain a desired quantity of fresh air from the intake manifold to the cylinder;

wherein controlling the quantities of residual exhaust gas and fresh air are performed to maintain the temperature in the cylinder at a desired level.

2. A method, as set forth in claim 1, wherein controlling the quantities of residual exhaust gas and fresh air are performed to increase the temperature in the cylinder to a desired level.

3. A method, as set forth in claim 2, wherein controlling the quantities of residual exhaust gas and fresh air are performed during low load operation of the engine.

4. A method, as set forth in claim 1, wherein varying operation of an intake valve includes the step of extending the open duration of the intake valve beyond a normal open duration.

5. A method, as set forth in claim 4, wherein extending an open duration of the intake valve includes the step of extending an open duration of the intake valve for a period sufficient to maintain a quantity of fresh air below a desired level.

6. A method, as set forth in claim 5, wherein extending an open duration of the intake valve includes the step of extending an open duration of the intake valve for a period sufficient to decrease a quantity of fresh air in the cylinder.

7. A method, as set forth in claim 1, wherein increasing a back pressure includes the step of controllably actuating at least one variable geometry turbine in a turbocharger system associated with the intake and exhaust manifolds.

8. A method for controlling a temperature in a cylinder of an internal combustion engine, comprising the steps of:

    determining a load condition of the engine;

    determining a cylinder temperature as a function of the load condition;

    determining a desired cylinder temperature;

    increasing a back pressure associated with an exhaust manifold located on the engine and fluidly connected to the cylinder to a level sufficient to maintain a desired quantity of residual exhaust gas in the cylinder; and

    extending an open duration of an intake valve located between the cylinder and an intake manifold fluidly connected to the cylinder to a duration sufficient to maintain a quantity of fresh air from the intake manifold to a level below a desired threshold;

wherein the increased back pressure and extended open duration of the intake valve are controlled to maintain the desired cylinder temperature.

9. An apparatus for controlling a temperature in a combustion cylinder in an internal combustion engine, comprising:

an intake manifold fluidly connected to the cylinder;

an intake valve located between the intake manifold and the cylinder;

an exhaust manifold fluidly connected to the cylinder;

means for increasing a back pressure associated with the exhaust manifold to a level sufficient to maintain a desired quantity of residual exhaust gas in the cylinder; and

means for varying operation of the intake valve to an open duration sufficient to maintain a desired quantity of fresh air from the intake manifold to the cylinder;

wherein controlling the quantities of residual exhaust gas and fresh air are performed to maintain the temperature in the cylinder at a desired level.

10. An apparatus for controlling a temperature in a combustion cylinder in an internal combustion engine, comprising:

an intake manifold fluidly connected to the cylinder;

an intake valve located between the intake manifold and the cylinder;

an exhaust manifold fluidly connected to the cylinder;

a turbocharger system connected between the intake and exhaust manifolds;

a variable intake valve system controllably connected to the intake valve; and

a controller electrically connected to the turbocharger and variable intake valve systems for controlling the turbocharger system to increase a back pressure associated with the exhaust manifold, and for controlling the variable intake valve system to vary an open duration of the intake valve, wherein the back pressure and the open duration of the intake valve are controlled to respectively maintain a desired increased quantity of residual exhaust gas and a desired decreased quantity of fresh air in the cylinder, such that the temperature in the cylinder is maintained at a desired level.

11. An apparatus, as set forth in claim 10, wherein the turbocharger system includes at least one variable geometry turbocharger (VGT).

12. An apparatus, as set forth in claim 11, wherein the turbocharger system includes two variable geometry turbochargers.

13. An apparatus, as set forth in claim 11, further including at least one VGT vane actuator connected to a corresponding at least one VGT and electrically connected to the controller.

14. An apparatus, as set forth in claim 10, wherein the variable intake valve system is configured to extend the open duration of the intake valve beyond a normal open duration.